



41

AF/2800

PATENT
Attorney Docket No. 0553-0246

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:
Koichiro Tanaka

Serial No.: 09/812,529 ✓

Filed: March 20, 2001

Examiner: R. Booth

Art Unit: 2812

For: METHOD OF MANUFACTURING A
SEMICONDUCTOR DEVICE

I hereby certify that this correspondence is
being deposited with the United States Postal
Service as first class mail in an envelope
addressed to:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450 on:

DATE: August 22, 2003

NAME: Shannon Wallace
SIGNATURE: Shannon Wallace

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE D (AFTER FINAL)

Applicant has the following response to the Final Rejection of May 22, 2003.

In the Final Rejection, Claims 1-13 continue to be allowed

The Examiner, however, rejects Claims 14-17 and 23-30 under 35 USC 103 as being unpatentable over Yamazaki et al. 5,365,080 in view of Yamazaki et al. 5,627,084. The Examiner further rejects Claims 18-22 and 31-40 under 35 USC 103 as being unpatentable over Yamazaki et al. '080 and Yamazaki et al. '084, and further in view of Kato et al. 5,589,406. Each of these rejections is respectfully traversed.

The present invention is directed to a method of manufacturing a semiconductor device. The method of the present invention includes irradiating an amorphous semiconductor film with a first laser beam and a second laser beam. In independent Claims 15, 16, 19 and 20, the first laser beam is an excimer laser beam. In independent Claims 14 and 18, the first laser beam has a

TECHNOLOGY CENTER 2800

RECEIVED
AUG 29 2003

wavelength of 308nm, while in independent Claims 17, 21 and 22, it has a wavelength of from 126 to 370nm. In independent claims 14, 15, 17, 18, 19 and 21, the second laser beam has a wavelength of 532nm, while in independent Claims 16, 20 and 22, it has a wavelength of 370 to 650nm.

Independent Claims 14, 15, 17-19 and 21

As explained below, independent Claims 14, 15, 17-19 and 21 are clearly patentable over the cited references.

While Yamazaki '080 discloses a YAG laser radiation for the second laser annealing step, Yamazaki '080 does not disclose a second harmonic of a YAG laser radiation. Yamazaki '084 discloses a second harmonic of a YAG laser. The Examiner, however, acknowledges that neither reference discloses a second laser beam having a wavelength of 532nm, as recited in Claims 14, 15, 17-19 and 21.

Further, in contrast to the cited references, in the method of the claimed invention, the first and second laser beams conduct first and second laser irradiation to crystallize the amorphous semiconductor film. Specifically, the method comprises irradiating the amorphous semiconductor film with a first laser beam to form a first crystalline semiconductor film, and irradiating the first crystalline semiconductor film with a second laser beam to form a second crystalline semiconductor film, wherein the second laser beam has a wavelength of 532nm. By use of the second laser beam, amorphous regions of the first crystalline semiconductor film are crystallized without disturbing the already-crystallized regions of the first crystalline semiconductor film because the second laser beam having a wavelength of 532nm is absorbed in an amorphous silicon more than in a polycrystalline silicon. Thus, a second crystalline semiconductor film having a high uniformity is obtained. Because neither cited reference

discloses or suggests the specific wavelength of the second laser beam, the claimed method and resulting advantages thereof are not disclosed or suggested by the cited references.

Therefore, for at least the above-stated reasons, the claimed method of independent Claims 14, 15, 17-19 and 21 is not disclosed or suggested by the cited references. Accordingly, these independent claims, and those claims dependent thereon, are patentable over the cited references.

Independent Claims 16, 20 and 22

As explained below, independent Claims 16, 20 and 22 are clearly patentable over the cited references.

While Yamazaki '080 discloses a YAG laser radiation for the second laser annealing step, Yamazaki '080 does not disclose a second harmonic of a YAG laser radiation. Yamazaki '084 discloses a second harmonics of a YAG laser. The Examiner, however, acknowledges that neither reference discloses a second laser beam having a wavelength of 370 to 650 nm, as recited independent Claims 16, 20 and 22.

Further, in contrast to the cited references, the claimed invention conducts first and second laser irradiations with the first and second laser beams to crystallize the amorphous semiconductor film with the first laser beam into a first crystalline semiconductor film, and to further crystallize the first crystalline semiconductor film with the second laser beam into a second crystalline semiconductor film. By the second laser beam, amorphous regions of the first crystalline semiconductor film are crystallized without disturbing already crystallized regions of the first crystalline semiconductor film because the second laser beam having a wavelength of 370 to 650 nm is absorbed in an amorphous silicon more than in a polycrystalline silicon. Thus, a second crystalline semiconductor film having high uniformity is obtained. Because neither

cited reference discloses or suggests the specific wavelength of the second laser beam, the claimed method and resulting advantages thereof are not disclosed or suggested by the cited references.

Therefore, for at least the above-stated reasons, the claimed method of independent Claims 16, 20 and 22 is not disclosed or suggested by the cited references. Accordingly, these independent claims, and those claims dependent thereon, are patentable over the cited references.

Independent Claims 14-22

Further, as compared to a YAG laser radiation having a wavelength of 1064 nm, a second harmonic of a YAG laser beam used in the present invention is suitable for crystallization of a semiconductor film. Because Yamazaki '080 does not suggest any wavelength for the YAG laser radiation used in the second laser annealing step, the method of present invention as claimed in independent claims 14-22 would not have been obvious in view of this reference.

Conclusion

Consequently, for at least the foregoing reasons, Applicant asserts that none of independent Claims 14-22 would have been obvious over the cited art. Claims 23-40, all of which are dependent claims, would also not have been obvious for at least the same reasons.

Accordingly, Applicant respectfully submits that the present application is in a condition for allowance and requests that it be allowed.

If any additional fee is due for this amendment, please charge our deposit account 50/1039.

Favorable reconsideration is earnestly solicited.

Respectfully submitted,



Mark J. Murphy
Registration No. 34,225

COOK, ALEX, MCFARRON, MANZO,
CUMMINGS & MEHLER, LTD.
200 West Adams Street - #2850
Chicago, IL 60606
(312) 236-8500